ASSUMPTIONS FOR ESD COST ESTIMATES

GENERAL

1. The cost estimates supporting the proposed Lower Harbor Confined Aquatic Disposal (CAD) Cell (LHCC) were prepared following EPA's guidance document, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*. EPA 540/R-00/002, July 2000. These cost estimates take advantage of actual costs experienced to date for various elements of the harbor cleanup, and as such represent as accurate an estimate as possible of future costs. Nevertheless, consistent with EPA guidance, and especially since many of the funding/remedial scenarios extend over 20 years or more, these estimates are expected to be accurate within –30 to +50 percent of the actual project cost.
2. Information in the cost estimates is based on the best available current information regarding the anticipated scope of the remedial alternative at this time. Changes in cost elements could occur as a result of new information and data collected prior to the detailed design of the remedial alternative.
3. When possible, actual costs from similar activities have been used to derive estimated costs. Because actual costs are inclusive of all aspects of an activity, including overhead and support costs, they are generally more accurate than cost estimates that do not include such actual costs.
4. Fixed costs (cost types that occur each year to implement the remedy) have been grouped and applied annually to the cost estimates. Fixed costs comprise costs for planning and reporting, project management, mobilization and demobilization, operational sampling and analysis, site operation & maintenance (O&M), Corps of Engineers (NAE) expenditures, sediment sampling and water quality monitoring, and upkeep of the site database. The fixed costs used in the cost estimates are based on actual values experienced at the site during remedy implementation to date.
5. Project duration is the time from the start of the project until remediation is complete and the site is demobilized. It has been assumed that the LHCC ESD will be approved in calendar year 2010 and the project will start in 2010.
6. Capital, annual, and periodic costs are estimated in 2010 dollars, and then escalated to the appropriate year using an annual escalation rate of 3.5 percent. This escalation rate is typical for the construction industry.
7. Real discount rates were used for present value (PV) calculations per EPA guidance (July 2000) and Office of Management and Budget Circular A-94, revised December 2009 (www.whitehouse.gov/omb/circulars/a094/a94_appx-c.html).
8. None of the alternatives include EPA costs for institutional controls, property leases, or project closeout cost. These costs are assumed to be similar for all alternatives.

9. The volume of contaminated material to be removed is the same for all alternatives. The total volume of material to be removed from all management units (MUs) is estimated to be 804,474 cubic yards (CY) (assumes MU-37 was reduced by 10,000 CY from the pilot underwater cap)[1]. In addition, it is assumed that cleanup passes will be required in MUs 1-24 and MUs 102-105, which adds an estimated 53,351 CY to the volume of material to be dredged. At the time these ESD cost estimates were developed, post-dredge bathymetric surveys indicated approximately 108,561 CY of of material had been dredged through 2008 and 56,400 CY were estimated to be dredged in 2009. Therefore, for the purposes of the ESD cost estimates, the remaining volume of material to be removed from the MUs is 692,864 CY. The wetlands requiring remediation (vegetated management units or VUs) comprise 47,976 CY. Figure 1 summarizes the dredge volume and disposal assumptions for both alternatives.
10. The cost estimates to build and cap the confined disposal facilities (CDFs) were developed by NAE in December 2007. The estimates did not include costs to maintain the CDFs during their construction and operation, and those costs were added for the purpose of this cost estimate. The cost to construct each CDFs appears as a portion of the total cost, proportional to the volume of the respective CDF.
11. Thirty years of CDF O&M has been added to the cost estimates as a line item with a PV cost. Because the cost occurs after the remediation work is completed and extends beyond the remediation project lifetime, the cost was calculated separately and only the PV is included in the line item. The annual O&M cost includes GW monitoring plus cap maintenance. The GW monitoring cost is the same annual cost that is used during the filling of the CDFs. The cap maintenance cost is based on the higher long-term maintenance unit cost for a Subtitle D landfill published in the September 1994 EPA document *Design, Operation, and Closure of Municipal Solid Waste Landfills*, EPA/625/R-94/008. The O&M costs are assumed to begin once the project is completed and occur annually for the first five years, bi-annually for the next 10 years, and every five years for the remaining 15 years.
12. A separate line item cost was also added to the cost estimates as a line item for 10 years of seafood monitoring, starting after the remediation is completed. The annual cost was estimated at $80,000, which was based on a current (2010) actual cost from MassDEP for seafood collection, lab analysis, data reporting, and labor, and included all overhead costs and fees. The ten-year PV is presented as a line item.
13. A separate line item cost for two additional rounds of benthic monitoring (years 5 and 10 after remediation is completed) was added to the cost estimates as a line item since these two final rounds are considered separate from remediation costs. The annual cost used in the PV calculation was the same as used for the benthic monitoring during the project.

[1] Foster Wheeler for USACE, *Volumes, Areas and Properties of Sediment by Management Units,* Rev 2, September 2003, Table 1 Physical Design Values.

14. Specific assumptions for individual alternatives are included in the individual cost estimating spreadsheets.

ALTERNATIVE 1, $15M/YEAR FUNDING SCENARIO

Alternative 1 is removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the 1998 New Bedford Harbor Site Record of Decision (ROD): transportation and disposal (T&D) to a certified hazardous waste landfill; and disposal in three upper harbor shoreline CDFs. The total capacity of the three CDFs is approximately 210,000 CY. The sand from the dewatering operations (assumed to be 10% of the total sediment volume, or 69,286 CY) will be disposed of in the CDFs. The remaining 140,714 CY capacity of the CDFs will be filled with filter cake from the dewatering plant. At the [ ] ratio of insitu CY of sediment to CY of filter cake experienced to date, this leaves 240,361 CY of filter cake to be shipped to a certified landfill.

For the $15M/year funding scenario of Alternative 1, the project lifetime is 46 years. Hydraulic dredging and dewatering occur all years, with the exception of years when CDFs are built and capped and years when wetlands, Marsh Island, and Cell #1 remediation are performed. Hydraulic dredging occurs in 32 of the project years.

Per EPA direction, the more highly contaminated filter cake (produced from earlier years of dredging) would be shipped off site so that the filter cake with lower levels of contamination would be disposed of in the CDFs. For the purposes of this cost estimate, it is assumed that all sand and oversize material from hydraulic dredging would be disposed of in the CDFs. Therefore, construction of CDF A would begin in Project Year 1 and take three years to complete. Hydraulic dredging would occur from Years 4–24 with disposal of sand into CDF A and shipment of filter cake to a certified landfill. In Years 25-26 CDF B would be constructed to contain the filter cake generated in Years 27-31. CDF C would be constructed in Years 31-34 for disposal of the remaining filter cake. Annual groundwater monitoring of each CDF would commence the first year material is placed in the respective CDF and continue for 30 years beyond capping of the CDF. However, for the purposes of this cost estimate, the annual groundwater monitoring cost begins the first year material is placed in the CDF and reoccurs each year the CDF is filled plus one additional year. The remaining 30 years of CDF groundwater monitoring is considered not a remediation cost, and has been presented in a line item cost for the three CDFs combined. In order to separate the 30-year cost for the purposes of this cost estimate, the costs were started in the year following the completion of the last cap.

Wetlands Remediation will occur in Project Years 42-44, after hydraulic dredging and Marsh Island Restoration are completed. A detailed cost estimate for wetlands restoration was developed for EPA in December 2007. The estimate included building temporary roads to access the wetlands, removal and T&D of material, backfilling,

planting, and temporary road removal. The 2007 cost estimate was modified in April 2009 by adjusting the wetlands area from *Volumes, Areas and Properties of Sediment by Management Units*, likewise adjusting linear feet of access roads, and including installation of silt curtains around the excavation areas. The NAE estimated the cost for the Marsh Island Restoration in 2007 at $2.61M, which was later increased to $2.75M to cover oversight and other costs.

In addition to the construction of CDFs, the following other costs have been included in this cost estimate.

- Benthic LTM is performed every five years at an assumed cost of $400,000 each event.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2009 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with this was provided by NAE in 2007 as $983,404.

- In Project Year 45, Cell #1 at Area C will be emptied, the material shipped to a hazardous waste landfill, and the abutting pilot CDF area will be capped. The cost of $15,573,194 was derived from a similar estimate prepared by Jacobs in February 2008.

- Following completion of hydraulic dredging, equipment and facilities associated with hydraulic dredging in Areas C and D will be demobilized. The demobilization cost for Areas C and D is the escalated rough order of magnitude (ROM) estimate prepared by Jacobs in December 2007 ($9,875,524) and includes complete demobilization and decontamination of equipment. This cost is carried in Year 46.

ALTERNATIVE 1, $30M/YEAR FUNDING SCENARIO

Alternative 1 is removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the 1998 ROD: T&D to a certified hazardous waste landfill; and disposal in three upper harbor CDFs. The total capacity of the planned CDFs is approximately 210,000 CY. The sand from the dewatering operations (assumed to be 10% of the total sediment volume, or 69,286 CY) will be disposed of in the CDFs. The remaining 140,714 CY capacity of the CDFs will be filled with filter cake. This leaves 240,361 CY of filter cake to be shipped to a certified landfill.

For the $30M/year Alternative 1 scenario with annual escalation of 3.5%, the project lifetime is 40 years. Hydraulic dredging and dewatering occur in Years 2-28. Capping of the CDFs occurs in Years 9, 16, and 29, as soon as each CDF is filled. Remediation of the wetlands, Marsh Island, and Cell #1 are performed subsequent to hydraulic dredging.

The $30M/year funding level was maintained until Project Year 20 at which time a minimum of 39 days of hydraulic dredging could not be maintained along with the fixed costs. For Project Years 20-27 the minimum number of hydraulic dredging days was set at 39, and the annual escalated cost rose as a result. In Project Years 28-40 the annual costs are greater than $30M due to the continually escalating fixed costs, and the need to complete CDF capping, wetland restoration, and demobilization in a reasonable timeframe.

A detailed cost estimate for wetlands restoration was developed for EPA in December 2007. The estimate included building temporary roads to access the wetlands, removal and T&D of material, backfilling, planting, and temporary road removal. The 2007 cost estimate was modified in April 2009 by adjusting the wetlands area from *Volumes, Areas and Properties of Sediment by Management Units*, likewise adjusting linear feet of access roads, and including installation of silt curtains around the excavation areas. The NAE estimated the cost for the Marsh Island Restoration in 2007 at $2.61M, which was subsequently revised to $2.75M to cover oversight and other costs.

Because 240,361 CY of filter cake will require T&D to a certified landfill under Alternative 1, for the $30M/year funding scenario construction of CDF A will occur in Project Year 1 and no hydraulic dredging will take place that year. Hydraulic dredging will occur from Years 2–9, generating sand and filter cake that will be disposed into CDF A. Approximately 77,000 CY of filter cake will be shipped to a landfill those years. For the purposes of this cost estimate, it is assumed that all sand and oversize material from hydraulic dredging will be disposed of in the CDFs. In Years 4-8 CDF C will be constructed to contain the sand, oversize and filter cake generated in Years 9-15. In Years 12-15 CDF B will be constructed for disposal of the sand, oversize and filter cake from Years 16-28. Operational groundwater monitoring of each CDF will commence the first year material is placed in the respective CDF, and will continue until each is filled, plus one year. Thereafter, the costs for groundwater monitoring and cap maintenance at each CDF are included in site O&M costs.

In addition to the construction of the CDFs the following other costs have been included in this cost estimate.

- Benthic LTM is performed every five years at a cost of $400,000 each event.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2008 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with re-competing the contract was provided by NAE in 2007 as $983,404.

- In Project Years 36-38, Cell #1 at Area C will be emptied, the material shipped to a hazardous waste landfill, and the abutting pilot CDF area will be capped. The cost of

$15,573,194 was derived from a similar estimate prepared by Jacobs in February 2008.

- Following completion of hydraulic dredging, equipment and facilities associated with hydraulic dredging in Areas C and D will be demobilized. The demobilization cost for Areas C and D is the escalated ROM estimate prepared by Jacobs in December 2007 ($9,875,524) and includes complete demobilization and decontamination of equipment. This cost is carried in Years 39 and 40.

ALTERNATIVE 1, $80M/YEAR FUNDING SCENARIO

Alternative 1 is removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the 1998 ROD: T&D to a certified hazardous waste landfill; and disposal in three upper harbor CDFs. The total capacity of the planned CDFs is approximately 210,000 CY. The sand from the dewatering operations (assumed to be 10% of the total sediment volume, or 69,286 CY) will be disposed of in the CDFs. The remaining 140,714 CY capacity of the CDFs will be filled with filter cake. This leaves 240,361 CY of filter cake to be shipped to a certified landfill.

For the $80M/year funding scenario of Alternative 1, the project lifetime is 6 years. Hydraulic dredging and dewatering occur all years; all remediation is completed in Year 6.

Construction of the CDFs will begin in Project Year 1; filling and groundwater monitoring will begin in Project Year 2. The sand from Dredge Season 1 will be stockpiled while the first CDF is constructed.

Wetlands Remediation will begin in Project Year 4. Under the $80M/year funding scenario, this activity can occur simultaneously with hydraulic dredging. A detailed cost estimate for wetlands restoration was developed for EPA in December 2007. The estimate included building temporary roads to access the wetlands, removal and T&D of material, backfilling, planting, and temporary road removal. The 2007 cost estimate was modified in April 2009 by adjusting the wetlands area from *Volumes, Areas and Properties of Sediment by Management Units*, likewise adjusting linear feet of access roads, and including installation of silt curtains around the excavation areas.

In addition to the construction of the CDFs the following other costs have been included in this cost estimate.

- Benthic LTM is performed once at an assumed cost of $400,000 for the event.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2009 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with re-competing the contract was provided by NAE in 2007 as $983,404.

- In Project Year 4, Cell #1 at Area C will be emptied, the material shipped to a hazardous waste landfill, and the abutting pilot CDF area will be capped. The cost of $15,573,194 was derived from a similar estimate prepared by Jacobs in February 2008.

- Due to the proximity of Marsh Island to the lower harbor MUs, this activity would have to occur after all the hydraulic dredging is completed. Therefore, the Marsh Island Restoration cost is scheduled for Project Year 5. The NAE estimated the cost for the Marsh Island Restoration in 2007 at $2.61M, which was subsequently increased to $2.75M to cover oversight and other costs.

- Following completion of hydraulic dredging, equipment and facilities associated with hydraulic dredging in Areas C and D will be demobilized. The demobilization cost for Areas C and D is the escalated ROM estimate prepared by Jacobs in December 2007 ($9,875,524) and includes complete demobilization and decontamination of equipment. This cost is carried in Year 6; the activity will occur after completion of hydraulic dredging this year.

ALTERNATIVE 2, $15M/YEAR FUNDING SCENARIO

Alternative 2 is Alternative 1 plus the proposed Lower Harbor CAD Cell (LHCC). The proposed LHCC would allow approximately 300,000 CY of contaminated sediment to be mechanically dredged from MUs 25-37 (theoretical volume is 271,000 CY from *Volumes, Areas and Properties of Sediment by Management Units*), transported down river by scow, and disposed in the LHCC. The removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the ROD, would be performed for the remaining upper harbor MUs.

In the $15M/year funding scenario of Alternative 2, the LHCC activities would take place first while the City has the LHCC area available. Finalization of the CAD cell design and construction of the LHCC would take place in Project Year 1, the equipment required for mechanical dredging and LHCC disposal would be purchased in Project Years 1 and 2, the silt curtain would be constructed in Project Year 2, the mechanical dredging and disposal into the LHCC would take place in Project Years 2-4 and the LHCC would be capped and the silt curtain would be removed in Project Year 6. For the $15M/year funding scenario of Alternative 2, the project lifetime is 40 years.

Once the LHCC is completed, the hydraulic dredging, T&D and CDF activities will commence, in a sequence similar to the sequence in the Alternative 1, $15M/year funding scenario, with the volume adjustments made for the lower harbor MU sediments disposed

in the LHCC. CDF A will be constructed in Project Years 5-7, and hydraulic dredging with T&D to a certified landfill will resume in Project Year 8.

CDF B will be constructed in Project Years 15 and 16 and CDF C will be constructed in Project Years 23-25. Monitoring of each CDF will commence the first year material is placed in the respective CDF, and will continue until each is filled, plus one year. Thereafter, the costs for groundwater monitoring and cap maintenance at each CDF are included in site O&M costs. Hydraulic dredging and filling and capping of the CDFs will be completed in Project Year 34.

Wetlands Remediation will occur in Project Years 36-39, after hydraulic dredging and Marsh Island Restoration are completed. A detailed cost estimate for wetlands restoration was developed for EPA in December 2007. The estimate included building temporary roads to access the wetlands, removal and T&D of material, backfilling, planting, and temporary road removal. The 2007 cost estimate was modified in April 2009 by adjusting the wetlands area from *Volumes, Areas and Properties of Sediment by Management Units*, likewise adjusting linear feet of access roads, and including installation of silt curtains around the excavation areas. The NAE estimated the cost for the Marsh Island Restoration in 2007 at $2.61M, which was subsequently increased to $2.75M to cover oversight and other costs.

In addition to the construction of the LHCC and CDFs, the following other costs have been included in this cost estimate.

- The CAD Cell design is currently in draft form and will require finalization. For the purposes of the Alternative 2 cost estimates, the cost to finalize the design is included in Project Year 1. The cost to finalize the design is estimated at $67,248, which is the escalated actual cost of the boring program incurred in 2006.

- Benthic LTM is performed approximately every five years, at an estimated cost of $400,000 each event.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2009 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with re-competing the contract was provided by NAE in 2007 as $983,404.

- In Project Years 34 and 35, Cell #1 at Area C will be emptied, the material shipped to a hazardous waste landfill, and the area will be capped. The cost of $15,573,194 was derived from a similar estimate prepared by Jacobs in February 2008.

- Following completion of hydraulic dredging, equipment and facilities associated with hydraulic dredging in Areas C and D will be demobilized. The demobilization cost

for Areas C and D is the escalated ROM estimate prepared by Jacobs in December 2007 ($9,875,524) and includes complete demobilization and decontamination of equipment. This cost is carried in Year 40.

- For 30 years following the capping of the LHCC the cap will be monitored. An event cost of $9,534 was based on the current cost to monitor the OU3 pilot cap. It is assumed that monitoring events would occur annually for the first three years, bi-annually for years 4-10, and every five years thereafter, beginning the year after the LHCC cap is completed. The PV for 30 years of LHCC cap monitoring is included as a line item.

ALTERNATIVE 2, $30M/YEAR FUNDING SCENARIO

This cost estimate was developed by applying a 3.5% annual escalation of cost each project year while maintaining a fixed funding level (i.e., not escalating the annual funding). The $30M/year funding level was exceeded in some years to accommodate minimum number of hydraulic dredge days, or when specific tasks required completion in a specific year or within a reasonable timeframe. For the $30M/year Alternative 1 scenario with annual escalation of 3.5%, the project lifetime is 26 years.

Alternative 2 is Alternative 1 plus the proposed LHCC. The proposed LHCC would allow approximately 300,000 CY of contaminated sediment to be mechanically dredged from MUs 25-37 (theoretical volume is 271,000 CY from *Volumes, Areas and Properties of Sediment by Management Units*), transported down river by scow, and disposed in the LHCC. The removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the 1998 ROD, would be performed for the remaining upper harbor MUs.

In the $30M/year funding scenario of Alternative 2, the LHCC would be built first while the City has the LHCC area available. Finalization of the CAD Cell design and construction of the LHCC would take place in Project Year 1, the equipment required for mechanical dredging and LHCC disposal would be purchased in Project Year 2, the silt curtain would be constructed in Project Year 2, the mechanical dredging and disposal into the LHCC would take place in Project Years 2-4, and the LHCC would be capped and the silt curtain would be removed in Project Year 5. In the $30M/year funding scenario, hydraulic dredging can continue while the LHCC is built and filled.

The hydraulic dredging, T&D and CDF activities will commence in Year 3 and occur concurrently with LHCC activities. The dredging will occur in a sequence similar to the sequence in Alternative 1, $30M/year funding scenario, with the volume adjustments made for the lower harbor MU sediments disposed in the LHCC. Hydraulic dredging and dewatering occur in Years 3-18; hydraulic dredging occurs in 16 of the project years. Capping of the CDFs and remediation of the wetlands, Marsh Island, and Cell #1 are performed in Years 20-26 for the purpose of this cost estimate. Some of these activities could occur simultaneously with hydraulic dredging.

CDF A will be constructed in Project Years 1 and 2 to receive the sand from the hydraulic dredging in Project Year 3. CDF C will be constructed in Project Years 4-8 and CDF B will be constructed in Project Years 12-15. Hydraulic dredging and filling of the CDFs will be completed in Project Year 18. Monitoring of each CDF will commence the first year material is placed in the respective CDF, and will continue until each is filled, plus one year. Thereafter, the costs for groundwater monitoring and cap maintenance at each CDF are included in site O&M costs.

Wetlands Remediation will occur in Project Years 23-26, after hydraulic dredging, demobilization and Marsh Island Restoration are completed. A detailed cost estimate for wetlands restoration was developed for EPA in December 2007. The estimate included building temporary roads to access the wetlands, removal and T&D of material, backfilling, planting, and temporary road removal. The 2007 cost estimate was modified in April 2009 by adjusting the wetlands area from *Volumes, Areas and Properties of Sediment by Management Units*, likewise adjusting linear feet of access roads, and including installation of silt curtains around the excavation areas. The NAE estimated the cost for the Marsh Island Restoration in 2007 at $2.61M, which was subsequently increased to $2.75M to cover oversight and other costs.

In addition to the construction of the LHCC and CDFs, the following other costs have been included in this cost estimate.

- The cost to finalize the CAD Cell design is included in Project Year 1. The cost to finalize the design is estimated at $67,248, which is the escalated actual cost of the boring program incurred in 2006.

- Benthic LTM is performed approximately every five years at a cost of $400,000 each event.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2009 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with re-competing the contract was provided by NAE in 2007 as $983,404.

- In Project Years 22 and 23, Cell #1 at Area C will be emptied, the material shipped to a hazardous waste landfill, and the area will be capped. The cost of $15,573,194 was derived from a similar estimate prepared by Jacobs in February 2008.

- Following completion of hydraulic dredging, equipment and facilities associated with hydraulic dredging in Areas C and D will be demobilized. The demobilization cost for Areas C and D is the escalated ROM estimate prepared by Jacobs in December 2007 ($9,875,524) and includes complete demobilization and decontamination of equipment. This cost is carried in Years 20 and 21.

- For 30 years following the capping of the LHCC the cap will be monitored. An event cost of $9,534 was based on the current cost to monitor the OU3 pilot cap. It is assumed that monitoring events would occur annually for the first three years, bi-annually for years 4-10, and every five years thereafter, beginning the year after the LHCC cap is completed. The PV for 30 years of LHCC cap monitoring is included as a line item.

ALTERNATIVE 2, $80M/YEAR FUNDING SCENARIO

Alternative 2 is Alternative 1 plus the proposed LHCC. The proposed LHCC would allow approximately 300,000 CY of contaminated sediment to be mechanically dredged from MUs 25-37 (theoretical volume is 271,000 CY from *Volumes, Areas and Properties of Sediment by Management Units*), transported down river by scow, and disposed in the LHCC. The removal of contaminated sediments by hydraulic dredging with two disposal methods, as currently allowed in the 1998 ROD, would be performed for the remaining upper harbor MUs. Under the $80M/year funding scenario, several activities have been assumed to occur simultaneously to take advantage of available funding. In years where total cost is less than $80M the activities are restricted by sequencing of activities and number of work days per year.

For the purposes of this cost estimate, the 271,589 CY of in-situ sediment material from MUs 25-37 will be placed in the LHCC and capped. The sediment will be mechanically dredged and will not be dewatered prior to disposal.

The total capacity of the three upper harbor CDFs is approximately 210,000 CY. The sand from the dewatering operations (assumed to be 10% of the total hydraulically dredged sediment volume or 42,128 CY) will be disposed of in the CDFs. The remaining 167,872 CY capacity of the CDFs will be filled with filter cake. This leaves 63,829 CY of filter cake to be shipped to a certified landfill. T&D of filter cake will take place in Project Years 1 and 2 to allow construction of the CDFs and allow the less contaminated material to be disposed in the CDFs.

For the $80M/year funding scenario of Alternative 2, the project lifetime is 6 years. Hydraulic dredging and dewatering occurs in Years 1 through 4; mechanical dredging occurs in Years 4 and 5. Wetlands remediation will begin in Project Year 4 and continue through Year 6. A detailed cost estimate for wetlands restoration was developed for EPA in December 2007 and modified in April 2009.

Construction of the CDFs will begin in Project Year 1; filling and groundwater monitoring will begin in Project Year 2. The sand from hydraulic dredging in Year 1 will be stockpiled while the first CDF is constructed. The CDFs will be filled as each one comes on line. Monitoring of each CDF will commence the first year material is placed in the respective CDF, and will continue until each is filled, plus one year. Thereafter, the costs for groundwater monitoring and cap maintenance at each CDF are included in site

O&M costs. The cost to cap all three CDFs is carried in Year 6, however, an individual CDF may be capped earlier if it reaches capacity.

Construction of the LHCC will begin in Year 1 and last three years so that there is no interruptions to remediation using hydraulic dredging. In Project Year 4, the equipment required for mechanical dredging and CAD cell disposal will be purchased, and mechanical dredging will begin. For the purposes of this cost estimate, it is assumed that mechanical dredging will take approximately 194 days. Therefore, due to available work days and multiple activities in Project Year 4, including installation of silt curtains around the CAD cell, it is assumed that mechanical dredging will carry over into Project Year 5. The CAD cell will be capped in Year 6 and the silt curtains will be removed.

Areas C and D will be demobilized in Year 5 and Cell #1 at Area C will be emptied and capped, thus removing the dredging and dewatering activities from Areas C and D. Marsh Island Restoration will occur after hydraulic and mechanical dredging is completed, and is included in Project Year 6 for the purposes of this cost estimate.

The following other costs have also been included in this cost estimate.

- The cost to finalize the CAD Cell design is included in Project Year 1. The cost to finalize the design is estimated at $67,248, which is the escalated actual cost of the boring program incurred in 2006.

- Similar to Alternative 1 $80M/year scenario, benthic LTM would be performed in Project Year 6 for Alternative 2 $80M/year.

- The NStar Crossing is assumed to occur in Project Year 2. This is a cost for relocating power lines that pass under the Acushnet River and must be relocated to complete the dredging. The cost estimate for this effort is $3M in 2009 dollars.

- In Project Year 3, a cost has been included for re-competition of the TERC contract. The cost associated with re-competing the contract was provided by NAE in 2007 as $983,404.

- For 30 years following the capping of the LHCC the cap will be monitored. An event cost of $9,534 was based on the current cost to monitor the OU3 pilot cap. It is assumed that monitoring events would occur annually for the first three years, bi-annually for years 4-10, and every five years thereafter, beginning the year after the LHCC cap is completed. The PV for 30 years of LHCC cap monitoring is included as a line item.

TABLE 1

COMPARISON OF ALTERNATIVES

Alternative	Funding Scenario	Actual Cost to Complete	Net Present Value (Cost to Complete in 2010$)	Time to Complete
1	$15M/year	$1.7B	$413M	46 years
1	$30M/year	$1.2B	$477M	40 years
1	$80M/year	$496M	$438M	6 years
2	$15M/year	$1.2B	$362M	40 years
2	$30M/year	$785M	$407M	26 years
2	$80M/year	$422M	$392M	6 years

FIGURE 1